MEMORANDUM

TO: John Cardwell, Regional Administrator
Chas Ariss, P.E., Wastewater Program Manager
Michael Camin, P.E., Regional Engineering Manager

FROM: Nicolas Hiebert, P.E., Staff Engineer

DATE: March 22, 2016

SUBJECT: M-195-03 Helmer Water and Sewer District, Staff Analysis supporting reuse permit re-issuance.

Executive Summary

The Helmer Water and Sewer District (District) owns and operates a wastewater treatment and land application site. The District's land application site was previously operated under DEQ permit LA-000195-02, which expired June 29, 2014 without an application for renewal. The District applied for a new reuse permit on August 17, 2015. The purpose of this memorandum is to satisfy the requirements of DEQ Rules, IDAPA 58.01.17 – Recycled Water Rules, for issuing Wastewater Reuse permits. It briefly states the principal facts considered in preparing the draft permit and provides a summary of the basis for the draft permit conditions. DEQ staff recommends renewing the District's wastewater reuse permit for 10 years with minor reductions in loading to match current conditions.

1 Introduction

The District owns and operators a very small wastewater collection and treatment system serving approximately 24 connections. The system was constructed in 1999 due to failing septic systems documented within the area. The treatment system includes a 1.7 acre agro-forest land application site for disposal of effluent and was originally permitted by DEQ under LA-000195-01. Additional description of the system is provided in Section 3 of this Memorandum.

Historically, the District has not used the land application site and has operated their treatment system as total containment lagoons (Shaffer 2013a). The District's most recent permit, LA - 000195-02, had an effective date of June 30, 2009 and expired on June 29, 2014. The District notified DEQ on July 14, 2014 of their intent to allow their reuse permit to expire (Shaffer 2014)and DEQ requested a reuse site closure plan in accordance with IDAPA 58.01.17.801. New District staff requested a pre-application meeting be held at Helmer to discuss options regarding their land application system. This meeting was held on February 26, 2015 and the District expressed their concern that should the need arise, the land application site could not be used without a permit (Hiebert 2015). The board indicated that they would like to proceed with renewing their expired permit. The District submitted a permit application on August 17, 2015. The permit application requests that the permit be renewed in accordance with the previous

permit and states that no modifications to the land application site have been made since the previous permitting cycle. It was noted that the permit application utilized the application forms from the previous permitting cycle. An application completeness determination was issued by DEQ on September 9, 2015.

2 Site Location and Ownership

The District is located approximately four miles east of the City of Deary along State Highway 3. The land application site is located down gradient of the lagoons with an approximately 100 foot buffer distance to Corral creek as shown in **Figure 1**. The District maintains access to the land application site by easement through adjacent private property located to the north and the site is secured with a locked gate.

Figure 1. Site Map and Surrounding Area

3 Process Description

Domestic wastewater is collected and treated from the 24 active connections within the District. The District's wastewater collection system is unique in that each residence has a septic tank on their service lateral. Wastewater is partially treated and solids are captured within each septic tank and then the effluent is discharged into the gravity collection system. The gravity collection system consists of 4-inch and 6-inch PVC pressure class pipe with a sealed access cleanout

located at each change in grade or direction. The District is responsible for operating and maintaining the septic tanks and collection system. This type of system is often referred to a septic tank gravity effluent (STEG) system. STEG systems are reported to have wastewater with a lower concentration of solids and nutrients due to partial decomposition of sewer occurring in the septic tanks. However, STEG wastewater can exhibit high levels of hydrogen sulfide that is noticeable by a putrid odor. At high levels hydrogen sulfide can pose a human health hazard. The District reports that the collection system is air tight and has performed well with no odor complaints to date (Viatli 2014).

The treatment system consists of two facultative lagoon cells. Cell 1 provides primary treatment and is approximately 0.5 acres with an operational storage of 0.74 million gallons (MG). Cell 2 provides additional treatment and storage. Cell 2 is approximately 1.5 acres and has an operational storage of 3.6 MG. Therefore, the total combine storage of Cell 1 and Cell 2 is 4.34 MG. A 6-inch sewer main conveys all wastewater to Cell 1 and enters at the northeast corner of the lagoon. Treated wastewater from Cell 1 is transferred to Cell 2 through 12-inch gravity pipe. The lagoons are reported to be in good working condition; free of major defects. It was noted that the storm water diversion ditches are in need of maintenance (Shaffer 2013a).

The system was originally design for effluent disposal utilizing a 1.7 acre agro-forest land application site. The land application site was designed based on 20 year population projection and flows of 70 people and 1.4 million gallons per year, respectively (Hammond 1998). The land application site is located south and down gradient of lagoon Cell #2. Two perforated pipe distribution laterals were installed as drip irrigation running north-south through the site. The site was originally designed for high yield poplar trees. Discussion with the District indicates that the hybrid poplar trees were not planted because grant funding for the project fell short. It appears the rational include a phased approach for planting the trees. Once the wastewater flow increased, necessitating effluent disposal, then poplar trees would be planted (Shaffer 1997). In addition, several components of the land application site do not appear to have been completed. This includes an effluent flow meter, disinfection facilities, monitoring wells, and piezometers. As previously discussed, growth within the area has not occurred as projected and the land application site has remained unused to date. It is unlikely that the District will need to utilize the land application permit unless current conditions change. Currently the land application site consists of native grasses and small evergreen trees typical to the area.

4 Site Characteristics

4.1 Site Management History

As discussed in Section 3, the treatment system has operated as a total containment system and the land application site has not been utilized to date. The system was inspected May 29, 2013 and the following issues were reported (Shaffer 2013):

1. The spring and stormwater entering the reuse site must be routed around the site for discharge to Corral Creek. The stormwater control structures around the lagoons need to be inspected and maintained properly. The runoff from the site needs to be retained on site. The access gate needs to be locked.

2. The underdrain outfalls need to be located and marked.
3. The operation manual needs to be followed, or changed to be pertinent to present operations.
4. The groundwater wells need to be installed so that wastewater effluent can be applied to the site if needed.
5. The Piezometer needs to be installed so that wastewater effluent can be applied to the site if needed.
6. The effluent flow measurement device needs to be identified and/or installed.
7. Chlorination facilities need to be identified and/or installed.
8. The system needs to retain the services of a properly licensed responsible charge operator.

The above items #3 through #8 appears to remain unresolved while items #1 through #2 were reported as completed (Viatli 2014). The remaining issues are included in the draft permit as compliance activities; see Section 9 for additional information. Items #4 through #7 are infrastructure improvements that are needed if the District does in fact use the land application site. As such, consideration should be given to providing realistic or triggered deadlines for compliance activities based on if the site is used within the permit cycle. Ideally these improvements should be completed prior to applying recycled water to the site and included as such in the draft permit.

4.2 Climatic Characteristics

The Helmer area is characterized by moderately warm summers and cold winters. The nearest similar weather station of record is located at Potlatch, ID; approximately 20 miles northwest of Helmer. The average annual precipitation is approximately 24.7 inches per year, of which 17.7 inches occur during the non-growing season (October 1 through March 31). The annual average maximum temperature is 58.7 °F and annual average minimum temperature is 33.4 °F.

4.3 Soils

Soil sampling was completed as part of the 1999 project. Soils are reported to be sandy clay to lean clay (DEQ 2009).

4.4 Surface Water

Corral Creek lies approximately 100 feet to the west of the land application site. The creek is reported to be intermittent (DEQ 2009).

4.5 Ground Water/Hydrogeology

Groundwater generally follows gradient of the terrain and flows towards the south and southwest. The nearest downgradient drinking water well appears to be located approximately 0.4 miles south of the land application site and is identified with Idaho Department of Water Resources well tag D0054217. The well is reported as drilled to a depth of 353 feet below ground surface with casing to 64 feet.

Seasonally high groundwater was reported within the site and is presumed to be influenced by spring runoff conditions and saturated soils. The shallow groundwater is reported to be less than 6 feet below the surface during these conditions (DEQ 2009).

4.6 Wastewater/Recycled Water Characterization and Loading Rates

4.6.1 Recycled Water Characterization

Constituents of primary concern for land application of municipal wastewater include chemical oxygen demand (COD), nitrogen, and phosphorus. Because the system has operated as total containment, influent and effluent wastewater characterization data is not available. The treatment system was originally designed based on a typical book value biological oxygen demand (BOD) loading rate of 0.17 pounds per day per person with a buildout population of 70 persons (Hammond 1998). This design loading did not account for any treatment within the septic tanks and appears to be conservative in nature. Because of this, effluent applied to the land application site within the new permitting cycle would be expected to have low BOD/COD concentrations. COD limits were not included in the previous permit and are not proposed within the draft permit.

Treatment occurring in septic tanks is likely to take place under anaerobic conditions. These treatment conditions do not typically reduce total phosphorus or total nitrogen. Thus it would be expected that influent and effluent total phosphorus and nitrogen concentrations would be within the range of typical lagoon treatment systems. Total phosphorus concentrations reported from facultative lagoon treatment is reported to range from 1 to 5 mg/L; while total nitrogen is reported to vary from 10 mg/L to 30 mg/L (Crites and Tchobanoglous, 1998).

4.6.2 Hydraulic Loading Rates

The land application site consists of native grasses and young evergreen trees. The District intends to retain the current vegetative ground cover and supplement plantings with native evergreen trees as deemed necessary to maintain a healthy and balanced native ecosystem. The University of Idaho has calculated precipitation deficit (P_{def}) for crops grown in various locations within Idaho (*http://data.kimberly.uidaho.edu/ETIdaho/*). This data can be used to calculate the average net irrigation water requirement (IWR) representing the hydraulic loading limits. The proposed monthly hydraulic loading limits are shown in **Table 1** as the IWR.

Table 1: Hydraulic Loading Rates [a]

Month	P_{def} - Forest [b,c]		P_{def} - Grass (Low Management) [b]		Weighted P_{def} [d]	IRR Eff	IWR
	mm/day	in/month	mm/day	in/month	in/month	(%)	gallons / month
April	0.21	0.26	0.55	0.67	0.5	90%	21,400
May	0.88	1.07	2.37	2.89	2.0	90%	91,500
June	2.92	3.56	3.15	3.84	3.7	90%	171,000
July	4.36	5.32	3.92	4.78	5.1	90%	233,200
August	3.35	4.09	3.56	4.34	4.2	90%	194,600
September	1.41	1.72	1.56	1.90	1.8	90%	83,700
				Totals	***17.2***		***795,400***

[a] Data from Potlatch 3 NNE Weather Station, latitude 46° 55' North, longitude 116° 53' West at an elevation of 2250 feet.
[b] P_{def} 80% exceedance data used to minimize the potential of hydraulic overloading under native forest scenario. Considers an average of 30 days per month.
[c] Orchard with no ground cover appears to most reasonably match for the existing conditions of Forest, young evergreen trees.
[d] Weighted average as 50% Forest and 50% Pasture Grass - Low Management. Developed based on visual survey of surrounding areas from aerial photography.

The total IWR during the growing season for is calculated to be 795,400 gallons per year. It should be noted that the proposed annual hydraulic limit is less than half of the previous permit limit of 2.24 MG, which was based upon the poplar trees with high irrigation water requirements. This reduction in allowable hydraulic loading is representative of the current site and should not limit the current operations. Should conditions change within the District necessitating additional irrigation capacity, a change in crop type or additional land would need to be implemented.

4.6.3 Constituent Loading Rates

Nitrogen and phosphorus are typically the most important constituents when considering loading limits. Of these two, nitrogen is usually the limiting factor; while phosphorus is rarely included as a limit for domestic recycled wastewater permits. When considering a native forest, nutrient uptake is divided between overstory and understory. The overstory considers the uptake within trees while the understory considers the uptake within grasses and shrubs growing beneath the trees. The methodology used to estimate the values below is described in detail within DEQ's *Guidance for Forested/Poplar Site Nutrient and Hydraulic Loading*, July 2012. **Table 2** provides a comparison of the allowable loading rates and the estimated theoretical loading rate that could be observed.

Table 2: Constituent Loading Rates

Loading Rates	Total Nitrogen	Total Phosphorus
Douglas-fir juvenile (Forest canopy covers 50% of the site) - (lbs/ac-yr)	55 [a]	n/a
Full understory (covers 100% of site) - (lbs/ac-yr)	35 [a]	n/a
Total Site Uptake (lbs/ac-yr)	90	20 [b]
Uptake Efficiency Factor (%)	80% [c]	80% [c]
Allowable Loading Rate (lbs/ac-yr)	*113*	*25*
Estimated Maximum Concentration of Effluent (mg/L)	30 [d]	5 [d]
Estimated Maximum Loading Rate (lbs/ac-yr)	*117* [e]	*20* [e]

[a] Table 13 DEQ's *Guidance for Forested/Poplar Site Nutrient and Hydraulic Loading,* July 2012

[b] Page 19 DEQ's *Guidance for Forested/Poplar Site Nutrient and Hydraulic Loading,* July 2012

[c] Page 17 DEQ's *Guidance for Forested/Poplar Site Nutrient and Hydraulic Loading,* July 2012

[d] Estimate maximum effluent concentration, see Section 4.6.1 of this Memorandum.

[e] Represents loading that could be expected if the hydraulic loading limit of 795,400 gallons was applied.

As seen in **Table 2**, the allowable loading rate and estimated maximum loading rate for total nitrogen are roughly equivalent at 113 lbs/ac-yr and 117 lbs/ac-yr, respectively. While the estimated maximum loading rate for total phosphorus is roughly 20% less than what could be used by site vegetation. Because the site would likely uptake all phosphorus applied to the site; a total phosphorus limit is not necessary. However, total nitrogen appears to be the controlling constituent and should be limited to the uptake of 113 pounds per acre per year (lbs/ac-yr). It should be noted that the proposed total nitrogen limit of 113 lbs/ac-yr represents a decrease from the previous permit limit of 144 lbs/ac-yr. This decrease is representative of the native vegetation currently being managed at the site and should not negatively affect current operations.

5 Site Management

As previously discussed, the land application site has not been used since construction in 1999. The land application site remains as constructed. After the new permit is issued, it is recommended that the District inventory the existing irrigation components and verify that they have remained in working order. This recommendation should be included as part of the final permit handoff and documented within the project files.

5.1 Buffer Zones

Buffer zones for protection of surface water, ground water, drinking water supplies, and the public is required by IDAPA 58.01.17.604. The DEQ Reuse Guidance Manual (DEQ 2007) provides recommended buffer distances for various reuse scenarios. A summary of existing and proposed buffer zones is shown in **Table 3**.

Table 3: Buffer Zones

Area	Existing Permit Buffer Requirements[1]	Guidance Buffer Zone Requirements[2]	Actual Buffer Distances
Nearest Inhabited Residence	300	50	~1,200 (North)
Nearest Public Water System	1,000	1,000	~1,700
Nearest Private Water Supply	500	500	~1,200 (at nearest residence)
Distance to the Public Access	50	0	~2,000 (Hwy 3)
Nearest Surface Water	100	50	100 (Corral Creek)
Fencing	Not required	Not Required	Three-wire pasture fence
Posting	Not required	Every 500 feet and each corner of the outer perimeter of the buffer zone of the site	Every 500 feet around application area perimeter

1. Buffer Zone Requirements in Reuse Permit LA-000195-02
2. The DEQ Reuse Guidance Manual provides recommended buffer distances for various reuse scenarios.

As shown in **Table 3**, all existing buffer zones satisfy the DEQ Guidance buffer requirements for Class C reuse. The Guidance buffer zones requirements along with total coliform limits are specified in the draft permit to satisfy the requirements of Class C recycled water.

5.2 Runoff

Stormwater is diverted around the treatment lagoon and land application site via ditches and conveyance structures. It was noted that routine maintenance to the stormwater conveyance structures was needed during the 2013 annual reuse inspection (Shaffer 2013a). As such, a runoff management plan has been included as a compliance activity in the draft permit.

5.3 Seepage Rate Testing

Table 4 contains a summary of seepage rate testing for the lagoons associated with this reuse permit. Seepage testing is required again in 2024, which is within the proposed permit cycle. Test procedures for completing seepage tests should be submitted at least 42 days prior to the due date shown in the table below.

Table 4. Seepage Rate Testing

Lagoon	Test Date Completion	Date of DEQ approval of test report	Seepage rate, inches/day	Allowable rate, inches/day	Date next seepage rate test is due
Cell 1	9/12/2014	1/22/2015	0.018	0.25	September 2024
Cell 2	10/3/2014	1/22/2015	0.116	0.25	October 2024

5.4 Waste Solids, Biosolids, Sludge, and Solid Waste

As previously discussed, the District is responsible for cleaning septic tanks at each residence; cleaning typically takes place every 5 to 10 years. It is reported that septic tanks typically remove 75 to 85 percent of total suspended solids (TSS) found within domestic wastewater (Crites and Tchobanoglous, 1998). As such, the wastewater entering the lagoons has low TSS concentration and few solids. Because of this it is expected that the lagoons exhibit minimal sludge buildup and will not likely need dredging within the proposed permit cycle.

5.5 Nuisance Odors

Due to the treatment scheme and rural nature of the site, nuisance odors have not been reported.

5.6 Cropping Plan

A harvestable crop is not anticipated under the proposed permit.

5.7 Grazing

Grazing is not anticipated at this time and will not be allowed under the proposed permit.

5.8 Salts

High salts are typical to industrial wastewater and are not observed within treated domestic wastewater.

5.9 Silvicultural Plan for forest sites

The site is currently being managed for native vegetation including young evergreen trees and understory grasses. Although it is unlikely that the District will land apply effluent volume of significance, a basic silvicultural plan should be developed for management of the site. This has been included in the draft permit as a compliance activity; see Section 9 for additional information.

6 Monitoring

Monitoring requirements are provided in the draft permit for the purpose of determining compliance with permit limits and providing long term benchmarking of site performance. A majority of the proposed monitoring is unchanged from the previous permit, which appears consistent with current DEQ monitoring objectives and methods (DEQ 2007).

6.1 Recycled Water Monitoring

Table 5 provides a summary of proposed monitoring for recycled wastewater. A compliance activity is specified in the permit to provide means to measure recycled water applied to the site. Shallow ground water at a depth of less than 6 feet below surface was reported during spring months of March through May. As such, the monitoring schedule includes measuring depth to groundwater daily during periods of use. The intent of this monitoring requirement is to ensure that shallow ground water is not present near the surface when applying recycled water to the site.

Given the nature of the Districts treatment facility, it is unlikely that nitrate-N or total dissolved salts would be present at levels of detection. However, due to the lack of monitoring data these monitoring constituents have remained in the draft permit. Monitoring requirements for these constituents may be reconsidered by DEQ given an acceptable period of data collection.

Table 5: Recycled Monitoring

Type of Monitoring	Sample Type and Frequency	Location
Depth to ground water	Daily (during periods of use)	To be established as compliance activity
Volume of wastewater land applied	Weekly (during periods of use)	To be established as compliance activity
Total Coliform	Grab/ Monthly (during periods of use)	Prior to land application, after treatment
- Total Kjeldahl nitrogen, as N - Nitrite + nitrate-nitrogen, as N - Total phosphorus, as P - Non-volatile dissolved solids - Chloride - pH	Grab/ Monthly (during periods of use)	Prior to land application, after treatment

6.2 Soil Monitoring

Soil monitoring is used to access soil and crop health and help evaluate long term performance of the site. **Table 6** provides a summary of proposed soil monitoring within the draft permit. No changes are proposed in the draft permit.

Table 6: Soil Monitoring

Type of Monitoring	Sample Type and Frequency	Location
- Electrical conductivity - Nitrate-nitrogen - Plant available phosphorus - pH	Annually first and last year of permit, March	Composite Samples
- sodium absorption ration (SAR) - Iron (DTPA-Fe) - Manganese (DTPA-Mn)	Annually last year of permit, March	Composite Samples

6.3 Ground Water Monitoring

Ground water monitoring is typically used to evaluate a facility's impact on ground water quality and also serves to assess compliance with the reuse permit and the *Ground Water Quality Rule*, IDAPA 58.01.11. Monitoring wells were not installed as part of the original project and remain an outstanding item. **Table 7** provides a summary of proposed ground water monitoring within the draft permit along with a Compliance Activity for installing monitoring wells.

Table 7: Ground Water Monitoring

Type of Monitoring	Sample Type and Frequency	Location
- pH -Temperature - Water table elevation - Total phosphorus, as P - Nitrate-nitrogen, as N - Nitrite-nitrogen, as N - Chloride - Specific conductance/electrical conductivity (µmhos/cm) - Total Coliform	Unfiltered grab sample/twice annually: April and October	To be established as compliance activity

6.4 Calculation Methodologies

Calculation methods to determine compliance with the permit will be based on the collected and analytical data. No variations are anticipated.

7 Quality Assurance Project Plan

The Quality Assurance Project Plan (QAPP) is a written document outlining the procedures used by the permitee to ensure the data collected and analyzed meets the requirements of the permit. The QAPP is used to assist the permittee in planning for the collection, analysis, and reporting of all monitoring data in support of the reuse permit and explaining data anomalies when they occur. It does not appear that a QAPP has been developed for the land application site. This has been included as a compliance activity.

8 Site Operation and Maintenance

The District will continue to own and operate the system. A properly licensed responsible charge operator and substitute responsible charge operator has been included as a compliance activity.

9 Compliance Activities

9.1 Status of Compliance Activities in Current Permit

No compliance activities were included in the previous permit.

9.2 Compliance Activities Required in New Permit

When developing these compliance activities, attention to developing a deadline is of importance for the permit to function properly. Compliance activity No. 4 through No. 8 must be completed prior to using the reuse site. However, the District may not necessarily need to utilize the reuse site if conditions remain the same. Therefore, a balanced approach between immediate needs and future planning is needed to successfully implement the permit. Several scenarios were considered in developing a timeline to complete the compliance activities No. 4 through No. 8:

1. Hard deadline based on a stipulated date.
2. Triggered deadline based on the need and/or desire to irrigate at the site
3. Triggered deadline based on growth.

A meeting with the District was held on March 9, 2016 to discuss the above options. The District indicated that a hard deadline could be difficult given the circumstances and was not preferred. In addition, very limited growth could be anticipated within the permit cycle and thus didn't appear realistic. The Board agreed that a triggered deadline based on the need and/or desire to irrigate at the site appeared most realistic. The Board requested that compliance activities No. 4 through No. 8 be required 180 days prior to irrigating the reuse site. Thus, the following Compliance Activities were developed and are specified in the draft permit:

1. The District is required to employ or retain a properly licensed responsible charge operator and substitute charge operator 1 year after permit issuance.
2. The District is required to submit an updated Plan of Operation that incorporates the requirements of the new permit within 2 years after permit issuance. The plan shall include a silvicultural plan for management of the trees on site and a runoff management plan to address stormwater concerns.
3. The District is required to complete the seepage testing of both lagoons before September 1, 2024. Submit the seepage test report within 90 days after completion of the seepage test. DEQ recommends submitting seepage test procedures at least 42 days prior to planned testing.
4. The District is required to submit a Quality Assurance Project Plan, including verification that the plan has been implemented by the facility, 180 calendar days prior to applying recycled water to the site.

5. The District is required to submit a Well Location Acceptability Analysis (WLAA) to DEQ 180 calendar days prior to applying recycled water to the site. The WLAA shall be prepared by a Idaho licensed professional engineer or geologist and provide analysis of existing groundwater conditions at the site. If groundwater monitoring wells are determined to be necessary to protect groundwater, monitoring wells shall be installed 90 calendar days prior to applying recycled water to the site.
6. The District is required to install piezometer(s) to measure groundwater level 180 calendar days prior to applying recycled water to the site.
7. The District is require to install a means of measuring recycled water volume to the land application site 180 calendar days prior to applying recycled water to the site.
8. The District is require to install means of providing disinfection 180 calendar days prior to applying recycled water to the site.
9. The District is required to schedule a Pre-Application Workshop one year prior to permit expiration.
10. The District is required to submit a permit renewal application 180 days prior to expiration of the existing permit.

10 Recommendations

Staff recommends the draft reuse permit be issued for 30 day public comment period. The permit specifies hydraulic and constituent loading limits and establishes monitoring and reporting requirements to evaluate system performance, environmental impacts, and permit compliance.

11 References

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